American-Eurasian J. Agric. & Environ. Sci., 10 (3): 464-469, 2011
ISSN 1818-6769
© IDOSI Publications, 2011

Determination of Detergent in Tehran Ground and Surface Water

[1]M. Ghoochani, [1]S. Shekoohiyan, [1]A.H. Mahvi,
[1]B. Haibati and [2]M. Norouzi

[1]Department of Environmental Engineering, School of Public Health,
Center for Environmental Research Tehran University of Medical Sciences, Tehran, I.R. Iran
[2]Department of Epidemiology, School of Public Health,
Faculty Members of Qom Medical Science University, Qom, I.R. Iran

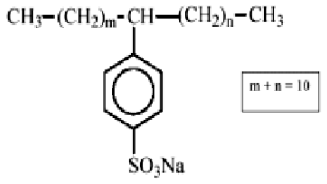
Abstract: Introduction: Detergents are group of chemicals that have cleaning power. These compounds generally contain a polar head group (soluble in water) and a no polar hydro carbonate tail (insoluble or poorly soluble in water). Detergents are used in everyday life and industries. Materials and methods: This study was done from June - February 2009 in three seasons (summer, autumn and winter) of three main channels Collector surface water and wells in downtown Tehran city in Iran. In order to determine the amount of anion surfactant used MBAS method (5540 C) standard method book. Results: This study showed that concentration of detergent in Tehran surface water (Firuz Abad, Sorkhe Hesar, Kan channels). Range of concentration detergent in Firuz Abad channel was 2.957-3.78 mg/l, Sorkhe Hesar channel 0.875-1.986 mg/l, Kan channel 0.1456-0.244 mg/l that showed Firuz Abad and Kan channels have high and low concentrations, respectively. The concentration of detergent in Taghi Abad, Amin Abad, Naghi Abad wells was in significant. Conclusion: The important of this study is the use of contaminated water from Firouz Abad and Sorkhe Hesar channels in south Tehran for cultivate vegetables and problems related to discharge detergents must be prevent from entering any urban and industrial wastewater to channels.

Key words: Detergent % Surface water % Ground water % Channel

INTRODUCTION

Detergents are group of chemicals that have cleaning power. These compounds generally contain a polar head group (soluble in water) and a no polar hydro carbonate tail (insoluble in water) surfactants consist of hydrophilic and hydrophobic properties in one molecule [1]. Component of detergents are surfactant (10-30%), materials manufacturer (constituent materials) (70%), sodium silicate (anticorrosion), amines (foam stabilizer), carboxyl methyl cellulose (pus hanger), sodium sulfate (filler) [2]. Surfactant molecules are to a large amount water-soluble and cause the foam in the wastewater treatment and water acceptor. Surfactants are used as the most compounds in production synthetic detergent[3]. These are used in everyday life and industries such as textile and paint industries, polymer technology, cosmetics, pharmaceuticals, paper and detergent production [4].

Surfactants are classified as anionic, cationic and non anionic and amphoteric by their ionic activity (special nature) in water [5]. LAS (Linear Alkyl benzene Sultanate) are mainly group of anionic surfactant that found in domestic and industrial wastewaters [6] and degrade by bacteria about 90-97% and decompose in small quantities in anaerobic conditions [7]. Anionic surfactants are used in extended volume than any other groups because of their ease and low cost of manufacture [8] that use about 1.8 million tons per year in detergent production [9].



Linear Alkylbenzene Sulfonate (LAS)

Corresponding Author: Amir Hosein, Mahvi, Department of Environmental Engineering, School of Public Health, Center for Environmental Research Tehran University of Medical Sciences, Tehran, I.R. Iran, Tel: +98-21-88954914, Fax: +98-21-88954914, E-mail: ahmahvi@yahoo.com.

Structural Formula of LAS: Discharge wastewaters containing detergent makes a lot of processing and environmental problems in water resources, that problem includes: disturbance of photosynthesis in fluid contact surface, reduction of speed breathing in bacteria, Prevention from enzymatic reactions and finally reduced degradation rate of organic matter, Groundwater contamination and toxicity to aquatic life [10]. also Process problems includes: Prevent the spread of oxygen, disorder in the sedimentation unit, coagulation and flocculation processes (deflocculating of Colloids and suspended solids, consuming more coagulants), Severe reduction of dissolved oxygen in aeration tank, Create severe foam, Emulsification of fats and oils and finally Eutrophication occur [11]. Detergent discharge Standard to surface and ground water is respectively 1.5, 0.5 mg/l [12]. The aim of this study is to investigate detergent of surface water (Firuz Abad, Sorkhe Hesar and Kan channel) and ground water (Taghi Abad, Ghani Abad and Amin Abad wells) in Tehran city. Firuz Abad, Sorkhe Hesar and Kan channels are three main channels for the collection of surface water in Tehran city that their water is being used for vegetable cultivation in south of Tehran.

MATERIAL AND METHODS

This study was conducted during June to February 2009 in Tehran, Iran (Figure 1). Tehran is the capital of Iran with a population of 12,150,742 inhabitants; it is also Iran's largest urban area and city, one of the largest cities in Western Asia and is the 20th largest city in the world. Tehran is the centre of most Iranian industries including automotive, electrical, textiles, cement and chemical. In the 20th century, Tehran was subject to mass-migration of people from all around Iran. Tehran features a semi-arid, continental climate. The climate is largely defined by its geographic location, with the towering Alborz Mountains to its north and the central desert to the south. It can be generally described as mild in spring, hot and dry in summer, pleasant in autumn and cold in winter, with an elevation of 1200 m (3,900 ft) above sea level.

This study was done in three seasons (summer, fall and winter) from three main channels collecting surface water and wells in downtown of Tehran city.

Channels and Wells Location Are as Follows: Firouz Abad Channel area is about 30 square kilometers and collects the surface water from West, South West and Central parts of Tehran city.

Sorkhe Hesar channel area is about 290 square kilometers and collects the surface water from North East, South East and Central.

Kan water course (river) is including six sub-branches with the area of 207 square kilometers.

Sampling location in each channel was fixed and the samples were taken from where there was possibility of sampling. Position sampling station in Firouz Abad, Sorkhe Hesar and Kan channels were respectively Emad avard Street, Afsariyeh crossing and Azadegan highway. Sampling was done during three seasons (summer, autumn and winter) and three times per month in year 2009 and in total 81 samples were collected. Also, from Taghi

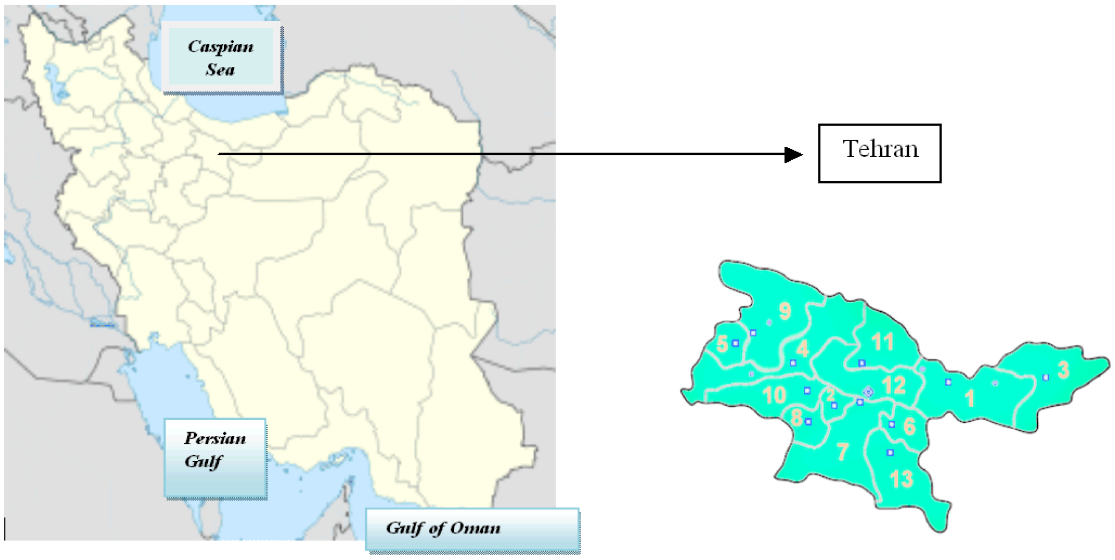


Fig. 1: Location of Tehran in Iran

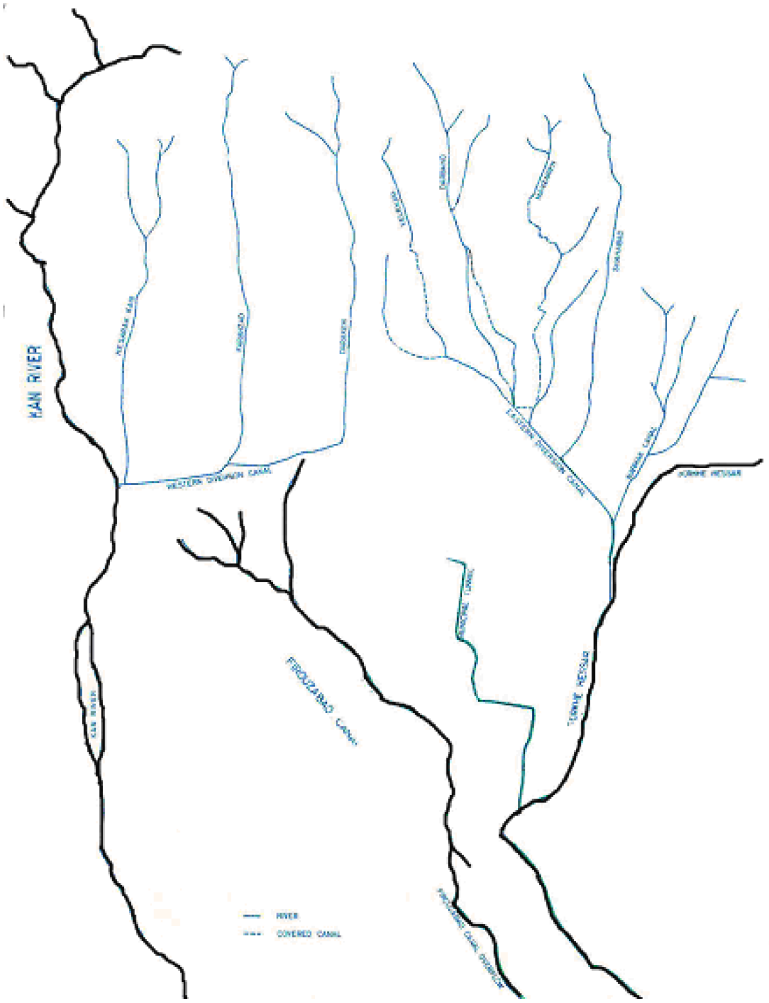


Fig. 2: location of channels collecting surface water in Tehran city

Abad, Ghani Abad and Amin Abad wells were sampled. Samples were collected in polyethylene container and near ice at 4°C and then transferred to laboratory. In order To determine the amount of anion surfactant, MBAS method was used [13]. Physicochemical parameters such as turbidity, temperature, electrical conductivity and pH were measured. Temperature and pH were analyzed on sampling sites. All conditions of sampling and testing guidelines have been based on Standard Methods for the Examination of Water and Wastewater [14]. To Determinate amount of detergent, spectrophotometer Perkins-Elmer Lambeda 25-UV/Vis in 652 nm wavelengths with the thickness of 1cm cell was used. (Language check) Turbidity and electrical conductivity were measured respectively by turbidity meter KODURAT SANG Hach 2100 AN model and electrical conductivity meter SENSION5 Hach EC model. Analysis of data was done by software Excel 2007 and SPSS version 18.

Table 1: Mean values of physicochemical parameters of sampling station of surface water channel.

Channel		Turbidity (NTU)	Conductivity(µs/cm)	pH	Temperature(°C)
Firuz abad	Mean ±SD	10.63± 1.71	502.11±98.90	7.56±0.07	10.93±3.94
	Min-Max	8.1-13.1	350-601	7.5-7.7	6.20-16.20
Sorkhe hesar	Mean ±SD	8.26±1.502	430.55±60.68	7.56±0.12	9.52±4.22
	Min-Max	6.5-11.2	315-485	7.4-7.8	5.10-14.3
Kan	Mean ±SD	8.001±1.169	369.3±41.18	7.4±0.10	1086±2.60
	Min-Max	6.30-9.71	310-420	7.30-7.6	7.7-14.1

RESULTS

Based on the above test method diagrams (Fig 3-5) related to the amount of detergent is given in three season in the Firouz Abad, Sorkhe Hesar and Kan channels. Also Graphs more related to each channel is provided.

Table 5 show the result of linear regression analysis in Firuz abad, Sorkhe hesar and Kan channels, no linear relation between detergent concentration and amount of turbidity and EC (electro conductivity) parameters were found.

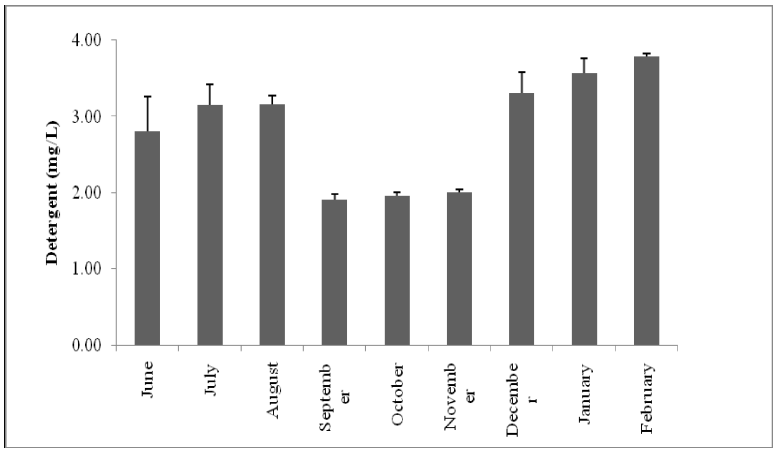


Fig. 3: Changes in the amount of detergent in Firouz abad channel at nine month of 2009-2010

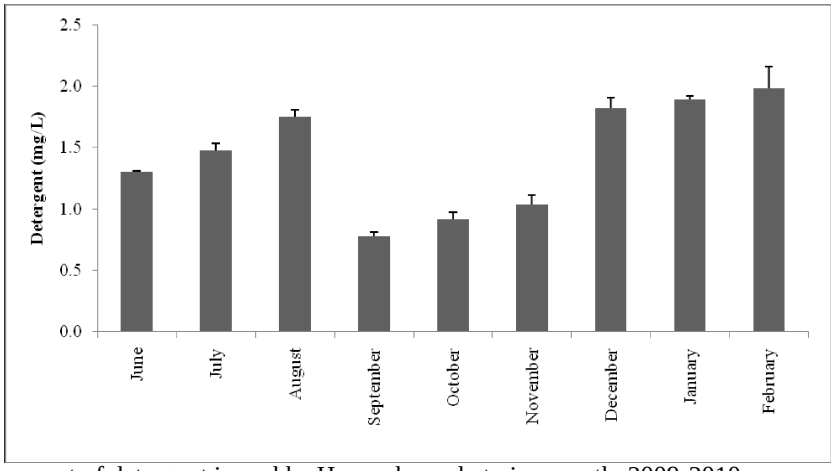


Fig. 4: Changes in the amount of detergent in sorkhe Hesar channel at nine month, 2009-2010

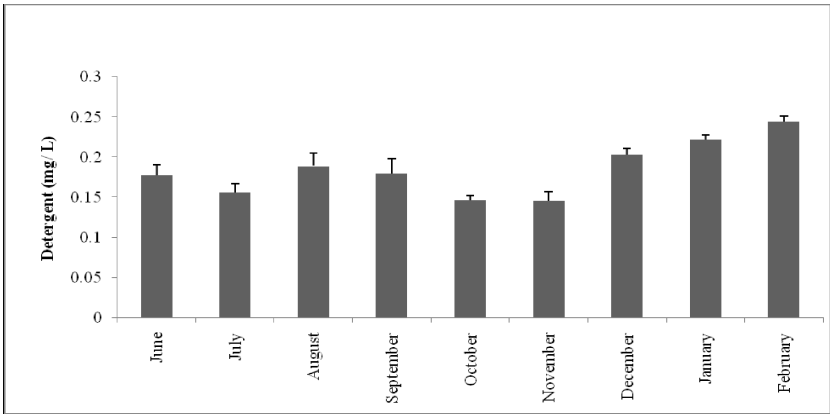


Fig 5: Changes in the amount of detergent in Kan channel at nine month 2009 -2010.

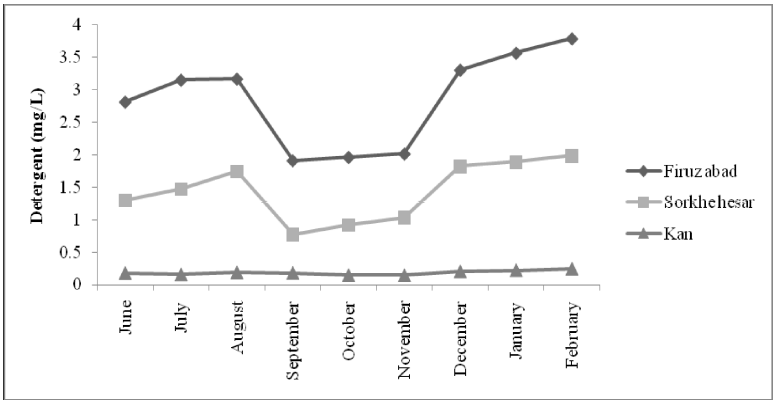


Fig. 6: Comparison of detergent in the above three channels at nine month, year 2009-2010.

Table 2: The results of linear regression analysis in three channels.

Channel	Parameter	R square	Sig.
Firuz Abad	Turbidity	00	0.968
	EC	0.019	0.726
Sorkhe hesar	Turbidity	0.407	0.065
	EC	0.001	0.948
Kan	Turbidity	0.11	0.384
	EC	0.029	0.663

DISCUSSION

Experiments on samples of ground water Ghani abadi, Taghi Abad and Amin Abad wells showed that very small amount of detergent in them and are zero.

The mean and standard deviation results for turbidity in Firuz Abad, Sorkhe hesar and Kan channel were respectively 10.631± 1.71 NTU (Nephlometric Turbidity Unit), 8.26± 1.502 NTU and 8.001± 1.169 NTU. Also for electrical conductivity were 502.11± 98.9 µs/cm, 430.55± 60.68 µs/cm and 369.3± 41.18 µs/cm.

In this study used linear regression analysis for determine the relationship between detergent concentration and physicochemical parameters in each channel. Because gradient temperature and pH in each channel was not too much, these parameters did not enter to regression analysis. Also, Minareci *et al* (2009) did not found relationship between detergent concentration and physiochemical parameters [15].

Results of experiments conducted on Firouz Abad, Sorkhe Hesar and Kan channels showed the amount of detergent were declining from summer to autumn and were increasing from autumn to winter. In winter highest and in autumn lowest quantity was observed. The results indicate that the amount of detergent is rising in above three channels in the winter. One reason for this increase, especially in February, can be attributed to the increase washing and cleaning home and cities due to approaching ancient Nowruz. Nowruz is the traditional celebration of the ancient Iranian peoples. Nowruz marks the first day of spring and the beginning of the year in the Iranian calendar. Spring cleaning or" complete cleaning the house" is commonly performed before Nowruz, therefore, the amount of detergent is increased. Reducing in the amount of detergent in the autumn season can be attributed to the increasing in rainfalls in Iran. Range of concentration of detergent in Firouz Abad, Sorkhe Hesar and Kan channels were respectively 1.905-3.78 mg/l, 0.775-1.986 mg/l and 0.1456-0.2441 mg/l. Firouz Abad and Kan channels have highest and lowest detergent concentration, respectively.

Pastewski and medrzycka (2003) measured anionic surfactants in Tricity agglomeration (Gdansk, Gdynia, sopot) in water samples. The concentration of anionic surfactants in the analyzed waters ranged from 5 to 150 µg/dm^3 [16]. Minareci *et al* (2009) in order to identify the point sources of detergent pollution and evaluate the effect on water quality, measured detergent in Gediz river in turkey, that concentration was 0.084 - 5.592 g/m^3 [15]. Imandel *et al* in 1978 reported the concentration of detergent in Tehran ground water was about zero-1.403 mg LG^1 as MBAS while it was lower than MCL expressed by standards [17]. Odokuma *et al* (1996) investigated seasonal influences of the organic pollution in Calabar River. They reported that amount of organic pollutants increased more in rainy than dry seasons. This research shows that detergent concentration in rainy seasons is higher than dry seasons [18].

Considering that the detergent discharge standard to surface water and ground water in Iran are 1.5 and 0.5 mg LG^1 [12], amount of detergent in the Firouz Abad and Sorkhe Hesar channels are exceed from standard level.

Due to use of contaminated water from Firouz Abad and Sorkhe Hesar channels in south Tehran for cultivate vegetables and problems related to discharge detergents must be prevent from entering any urban and industrial wastewater to channels. It mentioned that the study was done for first time in surface water channels in Tehran and no similar results were for compartment with literature.

ACKNOWLEDGMENTS

This study was conducted in the chemistry laboratory of school of public health and institute of public health, Tehran University of medical sciences. Authors would like to thank Mr. Esmaeilnejad for his assistance in field sampling.

REFERENCES

1. Ying, G.G.F., 2006. Behavior and effects of surfactants and their degradation products in the environment. Environment International., 32(3): 417-431.
2. Imandel, K., 1976. Degradation of linear alkyl benzene Sulfuneh non-linear environment: Tehran University of Medical Sci.,
3. Eddy, M., G. Tchobanoglous, F.L. Burton and H.D. Stensel, 2003. Wastewater Engineering: Treatment and Reuse. third ed: McGraw Hill. Inc.,
4. Madsen, T., H. Boyd, D. Nylén, A. Rathmann Pedersen, G. Petersen and F. Simonsen, 2001. Environmental and health assessment of substances in household detergents and cosmetic detergent products: Danish Environmenal Protection Agency.
5. Richards, A., 2003. Effects of Detergent Use on Water Quality in Kathmandu, Nepal: Massachusetts Institute of Technol.,
6. Dehghani, M., A. Mahvi, A. Najafpoor and K. Azam, 2007. Investigating the potential of using acoustic frequency on the degradation of linear alkylbenzen sulfonates from aqueous solution. J. Zhejiang University Science A., 8(9): 1462-8.
7. Salvato, J.A., N.L. Nemero. and F.J. Agardy, 2003. Environmental Engineering. 5, editor: John Wiley and Sons, Inc.,
8. Yangxin, Y., Z. Jin and A.E. Bayly, 2008. Development of Surfactants and Builders in Detergent Formulations. Chinese J. Chemical Engineering, 16(4): 517-27.
9. Fauser, P., P. Sørensen., L. Carlsen and V.J. Phthalates, 2001. Nonylphenols and LAS in Roskilde wastewater treatment plant: fate modelling based on measured concentrations in wastewater and sludge: National Environmental Research Institute.
10. Javid, A.H., A. Mirbagheri and M. Purtalary, 2006. Methods of detergent removal from industrial wastewater automotive industry and its standardization Environmental Science and Technol., 8(3): 29-34.
11. Imandel, K., 1995. Antiseptic and disinfectants and their application in environmental health: Tehran University of Medical Sci.,
12. Mahvi, A.H., N. AlaviNakhjavani and K. Nadafi, 2003. Removal efficiency Of detergent in Qods sewage treatment plants using activated sludge Ofogh danesh, Journal of Medical Sciences and Health Services Gonabad. 10(2): 36-41.
13. Closceri, L.S., A.E. Greenberg and A.D. Eaton , 1999. Standard methods for the examination of water and wastewater. 20 ed: American Public Health Association, American Water Works Association, Water Environment Federation.
14. APHA, AWWA, WEF, 1998. Standard Methods for the Examination of Water and Wastewater 20th ed: Washington, DC: APHA/AWWA/WEF.
15. Minareci, O., M. Öztürk., O. Egemen and E. Minareci, 2009. Detergent and phosphate pollution ýn Gediz River, Turkey. African J. Biotechnol., 8(15): 3568-75.
16. Pastewski, S. and K. M“drzycka, 2003. Monitoring Surfactant Concentrations in Surface Waters in Tricity Agglomeration. Polish J. Environmental Studies, 12(5): 643-6.
17. Imandel, K., N. Razeghi and P. Samar, 1978. Tehran ground water pollution by detergents. Water, Air and Soil Pollution, 9(3): 119-22.
18. Odokuma, L. and G. Okpokwasili, 1997. Seasonal influences of the organic pollution monitoring of the New Calabar River, Nigeria. Environmental Monitoring and Assess.,, 45(1): 43-56.
19. Mahvi, A.H., N. Alavi Nakhjavani and K. Nadafi, 2003. Removal efficiency Of detergent in Qods sewage treatment plants using activated sludge Ofogh danesh, J. Medical Sciences and Health Services Gonabad, 10(2): 36-41.